SCIENCE.

FRIDAY, DECEMBER 31, 1886.

COMMENT AND CRITICISM.

MR. EDWARD ATKINSON of Boston has for years ranked as one of the first statisticians in the world. To be a statistician implies a great deal. It implies more than a prodigious memory in retaining figures, and more than an untiring energy in gathering them together. The statistician must add to these qualities a graphic power of presentation and an insight into the real meaning of figures, which amount almost, if not quite, to genius. All of these qualities Mr. Atkinson possesses in a marked degree, and his two articles on 'The relative strength and weakness of nations,' contributed to the *Century magazine*, the first of which is published to-day, show them at their best. These articles are certain to be widely read and discussed, not only by the general reader, but by the economist, who will pay particular attention to Mr. Atkinson's methods and his interpretation of his results. Much of this first article reads like a chapter from 'Triumphant democracy,' and the ingenious illustrations used by the author add greatly to its force. Since 1865 we find that our population has increased 69 per cent; our hay-crop, 106 per cent; our cotton-crop, 194 per cent; our grain-crop, 256 per cent; our railway mileage, 290 per cent; our insurance against fire, 310 per cent; and our production of pig-iron, 386 per cent.

Mr. Atkinson's warning to the military powers of Europe is, 'Disarm or starve.' He holds that the annual product of a country is the source of wages, profits, and taxes. If one secure a larger proportion than now exists, the other two must supply it. Furthermore, Mr. Atkinson believes that wages, earnings, salaries, and the income of the small farm, are not the measure of the cost of production, but the results of the conditions, both material and mental, under which the work is done. From this it follows that the wages or earnings will be higher in that country which is not weighted down by the cost of a large standing army or the burden of a heavy war debt, and in which the work is done by the most intelligent people, under the most favorable conditions. The mental, material, and political influence of such a country will become the most potent factor in the world's commerce. This is the future Mr. Atkinson sees for the United States. The keynote of the argument for democracy against dynasties is commerce. Mr. Atkinson estimates the world's population at 1,400,000,000, of whom 400,000,000, are classed as machine-using. The other 1,000,000,000, being non-machine using, must depend almost wholly on the work of their hands for production. The control of the commerce of the world lies in the answer to the question, Which of the machine-using nations shall supply the need of the non-machine using nations? Mr. Atkinson sees that the nations of Europe cannot sustain themselves under their present conditions without commerce; but, if they hold to their present conditions, the United States, by virtue of its high wages and low cost of production, will take their commerce away from them. Therefore he says to the dynastic countries, 'Disarm or starve.'

The reasons for the vast gain in the conditions of material welfare in the United States, Mr. Atkinson finds to be seven. The first is the free purchase and sale of land, and the stability resulting from the large number of land-owners. The second is the absolute freedom of exchange between the states. The third is the extension of the common-school system. The fourth is the right of suffrage, with the consequent feeling of independence every voter possesses. The fifth is the conservation of local self-government in its strictest sense. The sixth is the existence of general state laws which preclude the possibility of any monopoly of the mechanism of exchange. The seventh is our habit of organization and self-government, which is so far developed, that "if any thousand persons were suddenly removed to some far-distant place, away from their fellow-men, the men of adult age would immediately organize an open meeting, choose a moderator, supervisor, or mayor, elect a board of selectmen, of assessors of taxes, and a school committee, appoint one or two constables, and then, adopting the principle of the English common law, would at once undertake their customary gainful occupa-

tions." These seven reasons may not be distinct, and we are inclined to believe that they are reducible to fewer; but, at all events, they form a comprehensive summary the value of which is not impaired by elaboration. Mr. Atkinson also negatives that foolish fallacy, now so widely held, that the "rich are growing richer, and the poor poorer." Its main force lies in the euphony of its expression.

Impressed, as we well may be, with the phenomenal development of the United States and the magnificent possibilities that lie before it, yet we must study development elsewhere as often as we can find it. That Great Britain has not been standing still for the past decade, Mr. Mulhall conclusively proves in the *Contemporary review*. Since 1875 the population of the United Kingdom has increased 12 per cent; wealth, 22 per cent; trade, 29 per cent; shipping, 67 per cent; and instruction, 68 per cent. During the ten years the natural increase of the population has been 1,200 daily, and the outflow to the United States and the colonies has averaged 600 daily. Besides this natural increase, there has been an immigration of 1,317,000 persons, consisting of returned colonists and foreign settlers: 65 per cent of the emigration came to the United States. Mr. Mulhall wants the medical association to investigate the fact, that, while the marriages have declined only 1.5 per cent. the births have fallen off 5.5 per cent. He considers that this furnishes ground for grave apprehensions of physical decadence. The condition of the people at large has materially improved in the ten years. Pauperism has declined (the rate per thousand of population being 27 in 1885, as against 41 in 1870, and 48 in 1850), savings-bank deposits have increased, and there has been increased consumption per capita of tea, sugar, meat, and grain. The criminal statistics show a large decrease in the number of committals, and the average number of children attending primary schools has risen 68 per cent in ten years. The bankruptcies are fewer than in 1875, and the consumption of alcoholic drinks has decreased.

Mr. Mulhall's conclusions from his study of the figures are very gratifying, the only two unfavorable items being the decline in the ratio of the number of births per marriage, and the lamentable condition of Ireland. The fall in the death-rate is ascribed to sanitary improvements and the increased consumption of wholesome food. The 24-per-cent decline in the consumption of liquor is especially to be noted, and considered in connection with the 82-per-cent increase in the savings of the working-classes, the larger amount of wheat and meat consumed, and the decrease of 36 per cent in crime and of 33 per cent in pauperism. Mr. Mulhall's figures are confirmatory of Mr. Atkinson's argument; for Great Britain is virtually a democracy, and, while subjected to a large annual expense for her army and navy, this is nothing like the drain upon her resources that the cost of their military establishments is to the great continental powers. Mr. Atkinson's further contributions to this discussion will be awaited with interest, and we shall expect some criticism of his fundamental tenets from economists.

Meanwhile Mr. Atkinson's position, that "high wages, either in money or in what money will buy, are the correlative or reflex of a low cost of production measured by labor or effort," receives an indorsement in some statistics that the United States consul at Tunstall has communicated to the department of state. He says in regard to silk, that, in a Macclesfield mill, 144 hands are employed in throwing 500 pounds of Canton silk, with average earnings of $2.25 a week; while in an American mill 80 hands throw from 1,000 to 1,200 pounds of Canton silk at an average wage of $5.50 per week. So American average earnings of $5.50 give far better results than the English average earnings of $2.25. This instance from the silk industry is supplemented by one from the boot and shoe industry; Frankfort-on-the-Main, and Lynn, Mass., furnishing the data. The price paid at a factory near Frankfort-on-the-Main for making uppers for ladies' high-top button gaiters is 21 cents a pair; while the cost of the same labor in Lynn, Mass., is 11 cents, or nearly 50 per cent less than in Germany. The whole boot, solid and finished, and laid in boxes, costs 33 cents in Lynn, which is far below what it is in Germany. The actual earnings in Germany, taken from the work accounts, are, on the average per hand employed, $3.38, while in Lynn they are not less than $9 per week.

The fallacy contained in the common saying that numbers cannot lie, is well shown in the recent discussion of the statistics of insanity by Dr. D. Hack Tuke. The statistics may be all right,

but they must be taken in a certain way to warrant definite conclusions. From the facts that more cases of insanity are now treated, that we have more asylums, and that our age is called a neurotic one, the mournful conclusion is drawn that a greater proportion of civilized humanity is succumbing to the stringent requirements of modern life, and losing its mental equilibrium. Dr. Tuke shows, that, by such statistics, the insane of the past thirty years or so, whose lives our improved methods of treatment have succeeded in prolonging, are pushed upon our shoulders. The real test of the prevalence of insanity is the proportion of first attacks occurring within certain periods. On this basis, Dr. Tuke shows that since 1878 (the earliest date from which adequate statistics exist) there is no increase in *occurring* insanity in Great Britain. On the whole, there is a slight tendency to decrease; and this, too, though cases are now more apt than ever to be brought to notice. Of course, this should not lessen our vigilance in the matter, nor remove our attention from that large class on the borderland of insanity which is not recorded, and from which any sudden crisis chooses its victims.

THE PHYSIOLOGY OF DIGESTION has been so thoroughly investigated of late years, that it would seem that there could be very little opportunity for difference of opinion on most of its leading principles, and yet we find that authorities are on some points very much at variance. We are told that nothing can be more prejudicial than the habit of chewing gum, supposed to be so common among school-children. The salivary glands are unnaturally excited, and pour forth so much saliva in the act, that when food is masticated they are not able to respond as fully as is necessary for the proper insalivation of the food. We are also informed that food should not be eaten just before retiring; that thoroughly refreshing sleep requires perfect repose of all the organs; and that, if we go to sleep with a more or less full stomach, sleep will be disturbed and unsatisfactory. The authorities of Amherst college evidently do not agree with these views. In the instructions which they give to their students to guide them in their gymnastic exercises, after specifying the kind and amount of physical exercise, they recommend sleeping for half an hour after dinner and supper if possible, and, if sleepless at night from brain-work, to eat a few graham crackers before retiring, to draw the excess of blood from the brain to the stomach. In reference to the practice of chewing gum, this statement is made: chewing gum daily before eating and between meals increases the flow of saliva, and so aids the digestion of fat-making foods. It also indirectly stimulates the secretion of the digestive juices of the stomach. We have no means of knowing, but we presume that Professor Hitchcock of Amherst, who is himself a physician, is largely responsible for this advice, and have no doubt that he has given it after mature consideration. We fully agree with what is said in the instructions about the usefulness of food in cases of sleeplessness, and believe that many a person has been kept awake at night from a mistaken idea of the necessity of abstemiousness before retiring. This, of course, does not mean that late suppers are under all circumstances to be recommended; but a few graham crackers can never do harm, and will often do good. In regard to the chewing-gum, we do not feel so sure. Besides being a practice which is from an aesthetic point of view not to be encouraged, it is very doubtful whether, under the most favorable circumstances, it is really a benefit to digestion; and, until there is some guaranty as to the composition of what is called chewing-gum, we should hesitate before recommending it in such unqualified terms.

A FULL ACCOUNT of the Union Pacific railroad weather-service has been furnished to the newspapers in the west by Lieutenant Powell of the signal service, who is in charge of the new enterprise, and now engaged in bringing it into shape for practical work. There will be thirty-three stations in all. It is proposed to issue predictions twice a day, announcing the expected weather changes from twenty-four to forty-eight hours beforehand. This will give the railroad officials ample time before the trains start in the afternoon and morning to make any changes which the predicted weather may necessitate. The predictions will be couched in specific language, and not in meaningless general terms. For instance: one indication will predict in a certain division cold weather with snow, the wind being from the north and blowing at the rate of thirty miles an hour, followed by warmer weather, the wind changing to a southerly direction. Study of the road will determine where the worst snow-drifts most frequently occur, and from this it will be possible to tell pretty nearly where snow blockades are liable to form. An accu-

rate and comprehensive weather-service will enable the Union Pacific to save thousands of dollars every week to its patrons. If storms can be accurately predicted beforehand, the stockmen can withhold their shipments and allow cattle to be sent through without danger of perishing by being caught in blockades or blizzards. One prominent cattleman recently said that such a system of predictions, if accurate, would be the means of saving him fifty thousand dollars every year. The practical working of this service will be watched with much interest by raiload men in all parts of the country.

In the prominent mention given just now to the meteorological enterprise of the Union Pacific railroad, it should not be forgotten that very considerable contributions towards increasing the value of the signal service are made by other roads. The display of weather-flags on many western and southern lines is no small matter, for one of the greatest difficulties that the service has to contend with is the delay in placing its indications in the hands of those who wish to know them. The predictions based on the seven A.M. observations, and issued about ten o'clock from Washington, are read by most persons only at five or six o'clock in the evening, or later, when the time covered by the prediction is already well advanced. Besides this, there is a large contribution of temperature, wind, and general weather observations made to the Pacific coast division of the service, at present in charge of Lieutenant Glassford, by the Southern Pacific railroad company. Observations are taken daily at seven A.M. at about a hundred and twenty stations on their wide-branching lines, making a valuable addition to the tri-daily reports from the twenty regular stations of the service on the Pacific slope.

The first published print of the topographical survey of Massachusetts, executed jointly by the U. S. geological survey and the state, was the map of the Greylock-Williamstown-North Adams district, issued last summer by the Appalachian mountain club on the scale of the original plane-table sheets (1 : 30,000), and of which mention has been made in *Science*. The same district is now published in its official form, on a scale of an inch to a mile (1 : 62,500), with brown contours every twenty feet, blue water-courses, and black roads, towns, and lettering. Old Greylock makes a fine centre for the sheet, and its sharply moulded form is well displayed in the crowded contours on its steeper slopes. The curious 'Hopper,' with its deep-cut outlet valley opening to the west, is one of the best-marked topographic forms in the state. There ought to be found here a nocturnal wind-stream as distinct as the water-stream that flows from so well-developed a drainage surface; for on calm clear nights, as the air near the ground cools by conduction to the radiating earth, it becomes heavy, and, if resting on an inclined surface, tends to flow down it; if a large surface lead downward to a narrow valley exit, like that from the Hopper, a distinct mountain breeze should be felt at the mouth. This should be studied and defined, so that our teachers need not go abroad to Switzerland, or even so far away as the Cordilleras of the west, to find illustration of phenomena that are doubtless distinct enough near home.

The deep valley separating Greylock from the Hoosac range is included in this sheet almost to the head of its stream, the Hoosic, a little south of the village of Berkshire. From the low pass that leads southward to the Housatonic valley, the Hoosic runs north before turning at North Adams westward to Williamstown, and therefore presents an example of that class of streams that suffered obstruction in the latter stages of the glacial period; for, when the southern marginal remnants of the ice-sheet lay in the deeper valleys, they blockaded the streams that ran towards them, and flooded them into lakes that commonly rose until they overflowed backwards across their divides to the south. Glen Roy in Scotland, with its 'parallel roads,' is a famous example of the kind; the Red River valley of Minnesota and Dakota is a very large illustration of essentially the same type; the northward-flowing Contoocook in New Hampshire has been obstructed in the same way, according to Upham; but not a single example of a valley thus modified has yet been described in Massachusetts. It is time that the many examples which undoubtedly exist should be brought to light, that they may contribute their share to the proper foundation of geographic study. Enough has been done in the broad, vague way of distant continental homologies: what is now needed is the local examination of minute topographic details, so that we may learn to see and appreciate the forms about us at home; and nothing will lead sooner or surer to this long-delayed end than the publication of good topographic

maps. The educational value of these maps will alone repay the people of Massachusetts over and over again for their share in the cost of making them.

WHENCE COME RACE CHARACTERS?

ONE is often led to speculate as to the origin of national peculiarities; and soon such speculations take one to the conclusion that a great deal of what characterizes a nation in the way of mental traits is not an intrinsic quality of the race, but akin rather to folk-lore, as to its origin at least. There are modes of the mind, and fashions of thought, which spread by propinquity. Such modes may give currency to superstitious tales of witchcraft, to foolish prejudices, or to great intellectual impulses. Every man's mind is a country inhabited by ideas, very few of which are autochthonous. His opinions are an immigrant populace; and, when a sturdy thought goes forth from the mind of its birth, it breeds abundant exact reproductions of itself in many other minds. Indeed, most thinking is repetitive. So, when a strong man appears, his example establishes a tendency in those about him; and, if he is highly endowed, he founds a school perhaps, of politics, art, or science, as the case may be. If many such men come in one epoch and in one nation, it may well happen that their conjoint impulses may lead a whole nation in a certain developmental direction, without the qualities which become prominent really being intrinsic race characters.

It is a legitimate question, and one possessed of deep meaning, Are the Germans more musical inherently than other peoples, or has the succession of splendid musical geniuses among them at once guided and accelerated the musical culture of the nation? The same alternative query arises concerning the pre-eminence of Italian painting or of English literature. Or we may make the complementary inquiry. Does the lack of certain qualities in a nation depend on the lack of the right leaders? To go back to the Germans, at whom indeed we are aiming all the while, do they lack American inventiveness because it is nowise in them, or merely because they have never been rightly impelled into the habit of invention by example-giving inventors? Probably for the latter reason, for German scientific men have done their share in inventing scientific apparatus, and the Germans who come to America learn to invent. The final interest of these considerations resides in the decision as to whether national defects of certain kinds cannot be remedied by tuition and right leadership. It must be left, however, for some powerful investigator to definitely solve these problems by rigid historical research. Let us, however, by an act of cheerful faith, accept the belief in possible betterment even unto thinking that the German people may acquire the literary instinct.

I have referred on several occasions in the columns of *Science* to the absence of the literary sense in German scientific men. It is one of the most flagrant arguments against the classical education, with its supposed results of literary culture, that the Germans, who have school doses of classics much larger and more concentrated than are administered in the rest of the world, themselves write more barbarously than any other civilized western people. German scientific articles are full of sentences like this, which refers to the bristles serving among arthropods as organs of touch: "Man darf für wahrscheinlich halten, dass die so sehr wechselnde gestalt und ausbildung der 'Tastborsten' nach der art des thieres und den körpergegenden noch bestimmten nebenzwecken zu dienen hat, ohne dass wir uns davon rechenschaft zu geben vermögen."[1] Now, the author of this sentence is one of the most distinguished and justly distinguished of German zoölogists, but his manner of writing is similar in quality to that of most scientific writers in Germany. The sentence is neither better nor worse than thousands upon thousands of others, perpetrated by his countrymen equally without literary feeling. The Germans need literary conscience to reprove them for all their awkward and involved phrases, that their souls may know how guilty they are in ignoring their readers' rights. The quoted sentence was evidently written without attention to the forms of expression. It never occurred to the author that aught was due the reader. His meaning cannot be had except by an effort. It is ill-mannered to give others so much trouble, when a little pains on one's own part might save it. A cultivated Frenchman would be incapable of such a rudeness. The pith of the evil is the indifference of the German author as to how he writes: he feels no inward necessity of having a good style, and is inclined to despise the French qualities of grace and lucidity.

Perhaps reiterated complaints will stimulate improvement. May it be brought about that the few good writers among German *savants* will have soon many imitators. It is, to be sure, more trouble to write well than to write ill. We all have facilities for bad logic, bungling rhetoric, and poor composition; but these undesirable gifts ought not to excuse us from striving after their

[1] *Zoologischer anzeiger*, IX. 288.

opposites. We cannot admit, therefore, that Germans are to be pardoned for not trying to present their many and valuable discoveries in articles well arranged and in language well chosen. It may be, however, that this will not come about until a set of leaders shall have established the 'folk-mode' of good writing. M.

THE HEALTH OF NEW YORK DURING NOVEMBER.

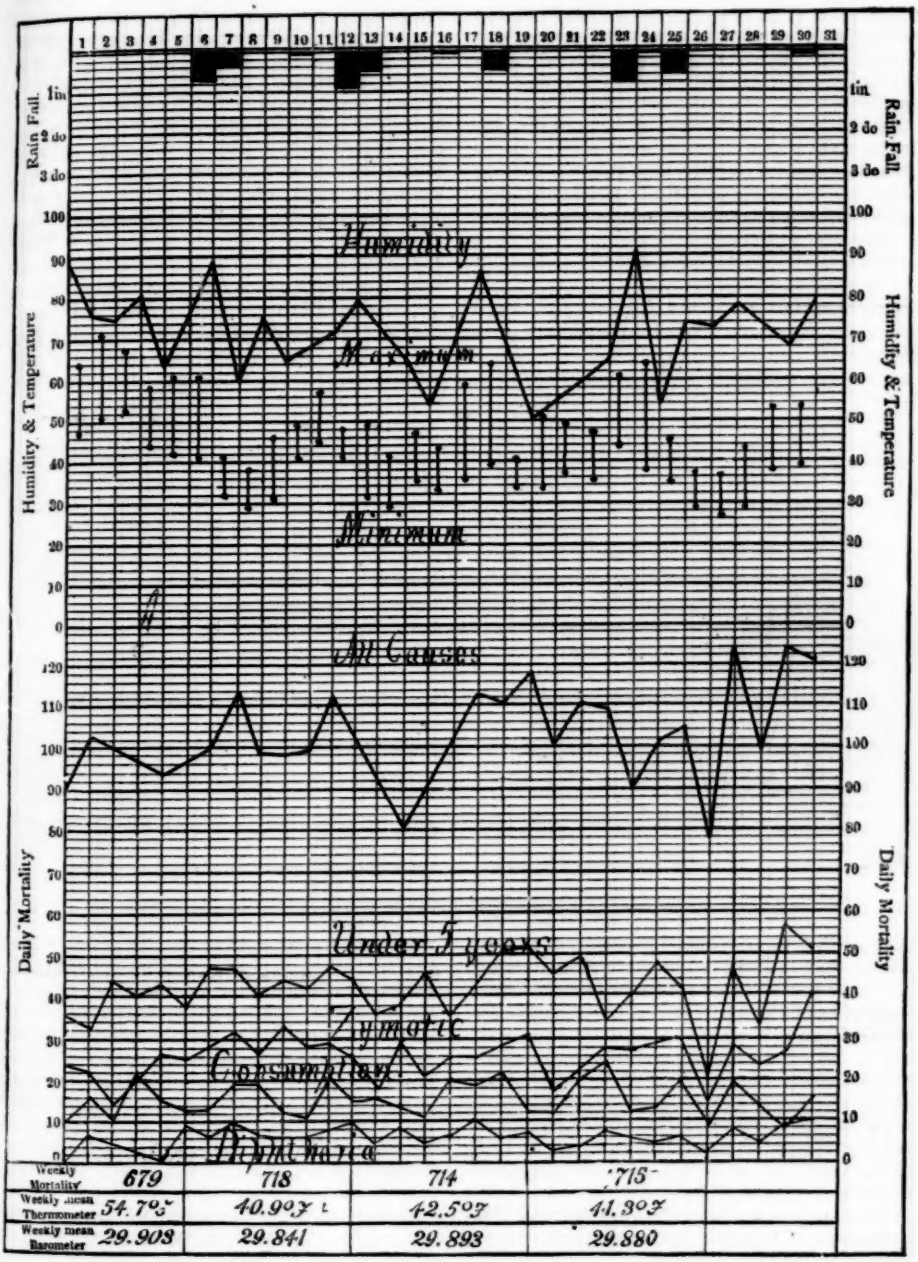
The total number of deaths which occurred in New York City during the month was 3,076, an increase of 99 over the previous month: 1,290 of these deaths were of children under five years of age. The decline in the mortality due to diarrhoeal diseases is very marked, being but 87 as compared with 234 in October. The deadly influence of the oppressive heat of our midsummers is nowhere better illustrated than when we compare the deaths from these diseases in July and in November. In the former month no less than 1,382 persons are recorded as having died from this cause, while in the latter but 87 succumbed to affections of the bowels. From consumption 459 persons died, an increase of 27 over October. Diphtheria, which began in October to figure more prominently as a mortality factor, has not yet relaxed its hold, and is chargeable with 188 deaths, 23 more than in the previous month. The deaths from scarlet-fever were only 23, practically the same as in October, the difference being but 5. Measles is now very prevalent in New York, and is assuming such proportions as a cause of death, that we shall in the future include it in our chart. Small-pox is still absent from the city, — a fact which reflects great credit upon the health department, for, with its prevalence in Brooklyn, it seemed almost impossible for New York to escape without becoming infected to a slight degree at least.

The meteorology of the month has not been characterized by any great variations from the normal or average, either as to temperature or rainfall. The maximum temperature was 71° F., at 3 P.M. of the 2d, the average for ten years being 67.9° F.: the minimum was 27° F., at 5 A.M. of the 27th, somewhat above the average of the past decade, which was 22.2° F. The rainfall for the month was 4.42 inches, 0.25 of an inch more than in October. The November average for ten years is 3.19 inches.

The *Fortnightly review* is to begin in its January issue the publication of a series of unsigned articles on 'The present political situation in Europe.' It is expected that these articles will be very important, and attract much attention.

A SKETCH OF THE GREAT SERPENT MOUND.

Accepting an invitation from Dr. Cyrus Thomas to accompany him on a visit to a number of the ancient monuments of southern Ohio, I had the long-wished-for opportunity of examining the great Serpent Mound. This work is situated in the northern part of Adams county, somewhat remote from frequented routes of travel, and hence rarely visited by people from a distance. Several accounts have been published, however, the first in the classic work of Squier and Davis, and subsequent ones by McLean, Putnam, Allen, and others. The map given in the first-mentioned work conveys, as far as it goes, a fair idea of the extraordinary structure, but is characterized by remarkable omissions. Some of the more decided shortcomings have been pointed out by recent writers, who have, in their turn, fallen into the opposite error of over-elaboration. I venture to present a few notes and observations which will assist in enabling those who cannot visit the locality, in gaining a clear conception of the work and its surroundings. The valley of Brush Creek is bordered by an extremely rugged country, abounding in high hills which reach an elevation of perhaps six hundred feet above the bed of the creek. Entering from the north, we skirt the eastern rim of the valley, and descend at Lovett's farm upon the subordinate levels that border the stream. Leaving the road and crossing the fields, with the Lovett dwelling on the right and a small circular mound on the left, we reach the brink of a steep cliff which descends about one hundred feet to the stream bed. Turning our faces up stream, we find ourselves at the insertion of a long, narrow spur, described as 'crescent-shaped,' which holds its level to the extreme point, and slopes abruptly to the brink of the cliffs at the left, and rounds off more gently into the deep gulch at the right. This spur narrows up farther on, and terminates in an abrupt promontory, around the base of which a small branch from the gulch at the right turns, and crosses the strip of alluvial bottom to the creek. Along the rounded grassy crest of this ridge we can detect the obscure serpentine coils of the earthwork, and descending a little to the left, and almost to the brink of the cliff, we reach the tail of the serpent. Beginning with a small pit at the terminal point, we follow the unfolding coil for two full turns, and then advance along the body to its highest point upon the ridge. The curves are strong and even, and the body increases gradually in height and width as we advance. Upon the crest of the ridge we find ourselves at the beginning of three great double folds. Following these, we descend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Weekly mean Barometer 29.908 29.841 29.893 29.880

into a slight sag in the ridge, caused by the encroachment of opposing drainage, and ascend again slightly to a point where the body straightens out along the ridge. Beyond this we reach the curious enlargement with its triangular and oval enclosures. Here the body embankment is divided into two parts, which respectively pass to the right and left of the enclosures. At the sides they descend slightly upon the slopes of the ridge, and at the widest part of the oval are somewhat obscure on account either of original conformation or of subsequent erosion. Beyond these breaks they continue, closing entirely around the oval embankment within. From the point of junction the body continues for a short distance, perhaps forty feet, and then terminates in a rounded and slightly widened point. This terminal elevation is entirely omitted by Squier and Davis, but is noticed by more recent writers; and, on account of the supposed presence of obscure auxiliary ridges of earth extending down the slopes to the right and left, it is likened to the body of a frog by Mr. McLean. These auxiliary ridges, and the minor appended features recognized by Squier and Davis and by some recent visitors, are too obscure to be identified with absolute certainty, and I consider it unsafe to introduce them into my illustration; but the entire body of the serpent, and the peculiar features of the enlarged portion, are all distinctly traceable, as shown approximately in the accompanying map, and leave no doubt in the mind as to their artificial character. The work was carefully laid out and neatly executed, and, reduced as it now is, it is of a most stable nature. The earth employed is extremely compact; and the elevation of the body is so slight, as compared with its width, that time, unassisted by the plough, produces but little change. The height rarely reaches three feet, and the width at the base is in many parts fifteen feet or more.

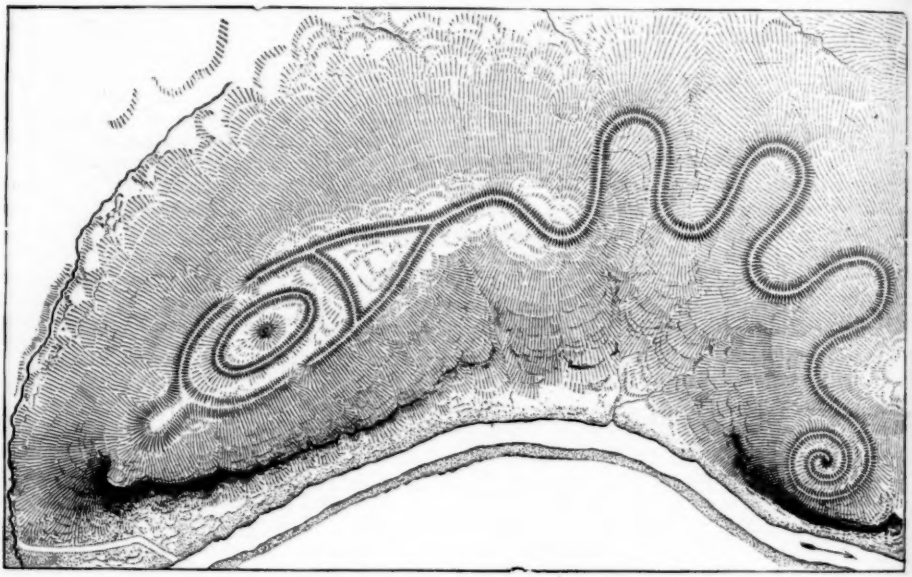

Fig. 1. — Sketch-map of the great serpent.

The topography of the outer end of the promontory is somewhat peculiar, and needs to be briefly described. The extreme point is about thirty feet beyond the end of the artificial embankment, and is slightly cleft in the middle. The right-hand portion has no exposure of rock, and descends in a narrow, rounded spur to the rivulet at its exit from the gulch. The left-hand point is a naked shelf of rock a little to the left of the direct continuation of the earthwork, and some ten feet below its terminal point. It is rounded at the margin, and perhaps twenty-five feet wide.

Descending upon this rock, we are upon the brink of a slightly overhanging ledge composed of rather compact, nearly horizontal beds of lime-

stone. The outline is curved, and presents a number of encircling ledges marking the thickness of the firmer strata. The rock immediately beneath is massive and coarse-grained, and, from rapid disintegration, has receded a number of feet, and exhibits a tendency to weather into caves. The entire exposure of rock at the point is perhaps forty feet in height. Beneath this a talus slope some thirty or forty feet in height, and covered with bushes, extends to the creek bottom. Descending the bluff at the left of the point, and crossing the belt of bottom land, we get a comprehensive idea of the promontory. In the sketch presented herewith, the numerous forest-trees and all undergrowth are omitted. It will be seen that from the point the exposure of rock extends back along the creek, descending slightly and soon disappearing, save where occasional masses project through the rounded slopes. The minute figure of a man is intended to indicate approximately the termination of the artificial embankment.

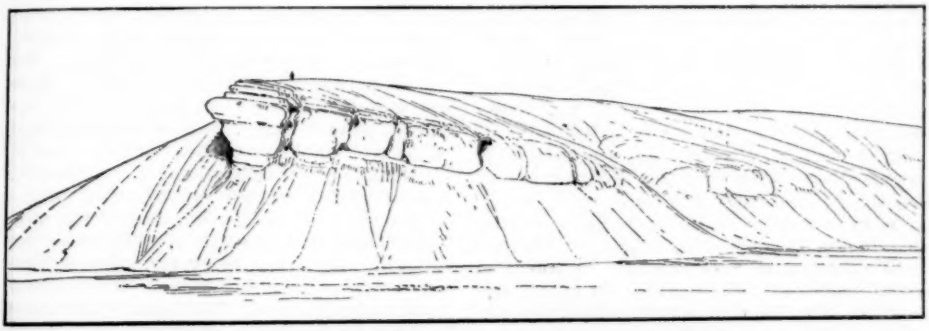

FIG. 2. — THE SERPENT HEADLAND FROM THE CREEK BANK, TREES OMITTED.

I wish now to call attention to a few points bearing upon the origin and significance of the work and its possible relations to the topography of the site. The use of the serpent by our aboriginal races has been well-nigh universal, so that we need not hesitate to class this specimen with other products of their religion, and we should naturally expect to find the counterpart of each feature in other representations, ancient and modern.

Most of the attempts to throw light upon the more extraordinary features of the work have been made through the medium of oriental philosophy; but it is manifestly wrong to go thus out of our way to seek a symbolism for the oval enclosure, as do Squier and Davis, who liken it to the symbolic egg of old-world philosophy; nor need we make a serious effort to combat the idea that the terminal portion is a frog, as suggested by McLean. It would not seem unreasonable that the former feature should be simply the eye of the effigy; but we have another explanation more in accord, perhaps, with the analogies of native ceremonial art. The heart, which represents the life, is made a prominent feature in all superstitious delineations of living creatures, as shown by a multitude of examples. When we restore the neck and head of the reptile, omitted by Squier and Davis and misinterpreted by others, the strange oval takes the position of the heart, and in all probability marks the site of the ceremonies that must have been connected with this work. This leads to a consideration of the proper identification of the head of the effigy, and the relations of the natural to the artificial features of the site. From the point of view of my second illustration, we have a comprehensive view of the serpent ridge. Having the idea of a great serpent in the mind, one is at once struck with the remarkable contour of the bluff, and especially of the exposure of rock, which readily assumes the appearance of a colossal reptile lifting its front from the bed of the stream. The head is the point of rock, the dark lip-like edge is the muzzle, the light-colored under side is the white neck, the caves are the eyes, and the projecting masses to the right are the protruding coils of the body. The varying effects of light must greatly increase the vividness of the impressions, and nothing would be more natural than that the Sylvan prophet, secluding himself in this retired part of the wilderness, should recognize this likeness, and should at once regard the promontory as a great manito. His people would be led to regard it as such, and the celebration of feasts upon the point would readily follow. With a mound-building people, this would result in the erection of suit-

able enclosures and in the elaboration of the form of the reptile, that it might be the more real. The natural and the artificial features must all have related to one and the same conception. The point of naked rock was probably at first and always recognized as the head of both the natural and the modified body. It was to the Indian the real head of the great serpent manito.

W. H. Holmes.

NOTES AND NEWS.

On the 8th of December, at Victoria, British Columbia, died Dr. W. F. Tolmie, known to ethnologists for his contributions to the history and linguistics of the native races of the west coast. Dr. Tolmie was born in Scotland, but had been resident on the west coast since 1833, at first as medical officer to the Hudson's Bay company's port of Fort Vancouver on the Columbia River, but afterwards becoming a chief factor in the company's service, from which he retired in 1870. During the Indian war in the Oregon territory in 1855–56, his knowledge of the language and influence among the Indians enabled him to render efficient service in pacifying them. Dr. Tolmie dated his interest in ethnological matters from his contact with Mr. Horatio Hale, who visited the west coast as ethnologist to the Wilkes exploring expedition. He afterwards transmitted vocabularies of a number of the tribes to Dr. Scoulèz and to Mr. George Gibbs, some of which have been published in 'Contributions to American ethnology.' In 1884 he published, in conjunction with Dr. G. M. Dawson, a nearly complete series of short vocabularies of the principal languages met with in British Columbia, and his name is to be found frequently quoted as an authority on the history of the north-west coast and its ethnology in the works of Bancroft and other authors. He was at all times ready to place his extensive and accurate knowledge on these subjects freely at the disposal of inquirers.

— The financial position of the American geographical society has been greatly improved in the past two years by the lease and possible sale of a portion of its real estate upon very remunerative terms. Upon the completion of this sale, and upon the sale of the building in Twenty-ninth Street now occupied by the society, the council have in mind the erection of a large building which will be an ornament to the city, and more suited to the growing needs of the society, — a building which will be fire-proof, to furnish the society with a safe and proper place in which to preserve its constantly increasing collection of valuable books and maps. The erection and furnishing of this building will necessarily entail increased expenditures, to provide for which, without burdening the present members, the council suggests that the number of fellows be largely increased. If each member will interest himself in this respect, the membership will be largely increased, and the amount which it is estimated the society will annually need in its new building will be the more readily attained.

— The English do not propose to permit the statue of Liberty in New York harbor to rank as the biggest on record, without a contest. The *Illustrated London news* comes forward with a description of the colossal statues of Bamian, together with measurements and illustrations. Travellers, oriental and occidental, have spoken of these statues from time to time, but accurate measurements of them were first made by the surveyors who were attached to the Afghan boundary commission. Bamian, where these statues are, is on the road from Cabul to Balkh, where it crosses the Paropamismus range. The elevation is about 8,500 feet above sea-level. There are five statues, three of them, including the largest, being in niches, the figures being formed of the rock within the niche. Captain Talbot of the boundary commission, using a theodolite, found the tallest statue to be 173 feet high, whereas the statue of Liberty is only 151½ feet high. Since Liberty is on a pedestal, however, the statue of Bamian must rank below her, unless the English propose to count its 8,500 feet elevation above sea-level as a pedestal. The Bamian statues seem to be Buddhist idols of great antiquity, and the natives have a variety of legends concerning them.

— The annual report of the coast and geodetic survey was submitted to congress recently. The report states that the demands upon the survey have been not only for accurate charts of the sea-coast, but also for correct data upon which the several states can base maps of the entire territory. During the past year, due consideration has been paid to immediate and pressing demands for resurveys of important harbors and highways of commerce, and special care was taken to give wide publicity to discoveries of dangers to navigation. Hydrographic surveys were prosecuted off the coasts or in the waters of fifteen states and two territories. Important investigations in terrestrial magnetism, physical hydrography, and geographical history, have been made. The aggregate of estimates for the next fiscal year ($560,765) is considerably larger than the appropriation for the current year, but is less than the

average appropriation for many years past. The report also speaks of the advance toward completion of the resurvey of New York bay and harbor, to the studies of ice formation and movement in Delaware river and bay, to the observation of currents in the Gulf Stream, and to the near approach of the transcontinental triangulations, which will form a geodetic connection between the work on the Atlantic and that on the Pacific.

— The remarkable regularity in the recurrence of climatic conditions, as well as the small variation in the weather on a subtropical island, is illustrated in the following table of maximum and minimum temperatures in the summer months of 1885 and 1886, at Nassau, Bahamas, clipped from a paper published there.

Month.	Temperatures, Fahrenheit.			
	Maximum.		Minimum.	
	1885.	1886.	1885.	1886.
May	85°	85°	67½°	67½°
June	86½	87	71½	73
July	88	88¼	75½	76½
August	88¾	87½	73½	73
September	87¼	86	73½	72½

Thunder-storms seem unpleasantly frequent. In 1885 there was lightning with rain every two days from May to September, with a violent storm about once a week; in 1886, lightning and rain were as frequent, but severe storms were reduced to only once a fortnight. The general absence of lightning-rods makes these storms a rather dangerous element in the summer weather of Nassau.

— An interesting case is reported to have occurred at Rising Sun, Ind. According to the accounts, a man named Seward, a farm-laborer, aged twenty-eight years, became sick about six months ago. At first there was nothing especially noteworthy about his sickness except that he was easily tired. Although a man of unusual strength, two hours of labor completely prostrated him. This increased, until, after two months, he was totally unfit for work, and at the same time his skin became changed in color. In health a blonde, with gray eyes, his face became ash-color, and then darker and darker, until, at the time of his death, it was like that of a negro. The neck, shoulders, hands, fore-arms, and afterwards other portions of the body, became similarly affected. The disease above referred to was undoubtedly what is known as Addison's disease. In 1855 Dr. Thomas Addison first described it. He regarded it as connected with disease of the supra-renal capsules, and since his day there has been but little more learned about its causation than Addison himself knew. The deposit of pigment in the lowest layers of the epithelium is the outward manifestation of the affection, though why it should be so deposited is not known. The disease occurs in adult life, very seldom in childhood or in old age. Males and laborers are usually the patients. Although it may last for many years, it is almost invariably fatal. Dr. Greenhow has devoted especial attention to this disease, and treats of it in the 'Croonian lectures on Addison's disease,' published in the *Lancet* in 1875. In vol. iii. of 'System of medicine by American authors,' is an article on the subject, written by Professor Osler, to which we would refer those who desire more particulars of this remarkable disease.

— The next number of the Proceedings of the American society for psychical research is to be issued as soon as sufficient material is collected. The council is anxious to obtain, so far as may be possible, the co-operation of all members and associate members of the society, in the preparation of this number. All members are therefore earnestly requested to report any experiences or observations which they may have collected on any subjects falling within the range of the society's work. Edw. G. Gardiner, 12 Otis Place, Boston, Mass., is the secretary.

— A curious feature of the weather, described in the Ohio meteorological bureau report for September last, is the damage caused by the lightning in a violent storm on the 23d of the month. The rain was very heavy at certain stations, Sidney reporting 5.57 inches in twenty-four hours. At New Bremen the storm began at 8 P.M. on the 22d, with high wind and hail-stones. From 2 to 3 A.M. on the next morning there was a continuous blaze of lightning. As the storm moved eastward, it entered a region of oil-wells, where derricks and tanks were struck, and large quantities of oil set on fire. At Lima the lightning struck a derrick, and ran thence by a pipe-line to a tank thirty rods distant, where it fired a thousand barrels of oil. Old oil-men said they had never experienced such storms in the Pennsylvania oil-fields, and were anxious to know if they were common in Ohio. The Ohio monthly report now occupies fifty-eight pages, and presents the records of thirty-seven stations in much detail.

— The northern portion of the Sierra Nevada, as recently summarized by Diller in bulletin 33 of the U. S. geological survey, may be briefly described as an old lowland made up of granite

and tilted and folded slates, worn down smooth, close to its base level of erosion, and then recently unevenly elevated in three great blocks. Every block is slightly tilted to the westward, and separated from its neighbor by a fault with bold face, falling steeply to the east. Longitudinal valleys lately occupied by lakes lie between the eastern face of one block and the long western slope of the next. During and since the uplift, streams flowing westward down the longer slopes have cut deep cañons. The date of the faulting is in great part later than the lavas of Lassen's Peak and thereabouts, and it is at least very likely that the dislocation is still in progress. The limestone beds of the region are considered of carboniferous age by previous observers, but a large portion of the auriferous slate series is thought to be of older origin.

— A recent supplement (No. 83) to Petermann's *Mittheilungen* contains an elaborate account by Dr. Berndt, of the effects of the foehn — the hot, dry wind of the Swiss valleys — on organic and inorganic nature. The memoir is prefaced by a good description of the wind itself: it is illustrated by a map showing the valleys, south as well as north of the divide, that are most frequented by it, and also by two weather-charts for the foehn of Feb. 20, 1879, demonstrating its relation to a cyclonic area of low pressure that crossed Europe from France over central Germany on that day. The body of the work is concerned with the action of the foehn on the mountain snow, and the floods thereby produced in the valleys, with its relation to rock-weathering and consequently to topography, and to its effects on plants, animals, and men. The danger of village fires is great during the prevalence of the hot wind, and extra watchmen are employed then. After the town of Glarus was thus burned in 1861, even smoking was prohibited outdoors and in the public streets during the blowing of the foehn.

— Dr. Forel, the distinguished Swiss entomologist, has recently published an account of experiments designed to ascertain whether the perception of the ultra-violet rays of the spectrum by ants took place by means of their eyes, or as a photo-chemical action on the skin. By varnishing the eyes of some ants, it became evident that the main impression was a visual one: such ants did not exhibit the preference for darkness above ultra-violet light which normal ants showed. This does not absolutely exclude any action on the skin, but makes it improbable. It is interesting to note that the blind are unable to judge of the amount of light in a room if care is taken to exclude the effects of heat and other indications.

— The college building in Charleston was so much injured by the recent earthquake that they have been obliged to pull down entirely the two wings, equivalent to nearly half the space occupied by the whole building. Half of the specimens in the museum of natural history, and all the physical and chemical apparatus, have been removed, and crowded into the remaining portion, which has also to serve for lecture and recitation rooms. The private library and collection of Mollusca and Crustacea belonging to Prof. L. R. Gibbes, and probably the most valuable in the south, were also in one of the wings, and of course had to be removed. Our naturalists will have great sympathy for those upon whom this unlooked-for labor has fallen, but will be glad that the collections are uninjured.

— A very interesting communication to the *Medical news* has been made by Dr. F. Peyre Porcher of Charleston, on the influence of the recent earthquake shocks in that city upon the health of the inhabitants. In addition to the natural alarm and fright which were quite universal, some persons were attacked with nausea and vomiting, which recurred or persisted in several cases for days. Two gentlemen on the islands eighty miles from Charleston had their eyes filled with tears not to be repressed, but not caused by alarm, or fears for their personal safety, for the danger there was not imminent. Many persons experienced decidedly electrical disturbances, which were repeated upon the successive recurrence of the shocks. These were generally 'ingling, pricking sensations, like 'needles and pins,' affecting the lower extremities. One gentleman was completely relieved of his rheumatism; another, who for months was nervous, depressed, and entirely unable to attend to business, regained his former activity and energy. Several cases of mental disturbance, owing to anxiety and prolonged loss of rest, some of them persistent, occurred among Dr. Porcher's patients.

— We had occasion in a recent number of *Science* to refer to a remarkable case in which the breath of an individual, or rather the eructations from his stomach, took fire when brought in contact with a lighted match. This case, which was reported in the *Medical record*, has called forth communications from physicians by which it would appear that the phenomenon is not such a rare one as was at first supposed. In one case of disordered digestion the patient emitted inflammable gas from the mouth, which, upon analysis, was found to be largely composed of marsh gas. In another case the gas was sulphuretted hydrogen. A case is reported in the

British medical journal, in which, while blowing out a match, the patient's breath caught fire with a noise like the report of a pistol, which was loud enough to awaken his wife. One evening, while a confirmed dyspeptic was lighting his pipe, an eructation of gas from his stomach occurred, and the ignited gas burned his mustache and lips. In Ewald's book on indigestion, the analysis of the gas in one of these cases was, carbonic acid, 20.57; hydrogen, 20.57; carburetted hydrogen, 10.75; oxygen, 6.72; nitrogen, 41.38; sulphuretted hydrogen, a trace. The origin of these gases is undoubtedly the undigested food, which in these cases undergoes decomposition.

— Dr. Gilles de la Tourette finds that the average step of men is twenty-five inches; for women, twenty inches. The step with the right foot is somewhat longer than that with the left. The feet are separated laterally in walking about four and one-half inches in men, and five in women.

LETTERS TO THE EDITOR.

***Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

Cremona's Projective geometry.

YOUR review of this work does scant justice, I think, to one of the most valuable text-books recently published. We have a multitude of elementary books in all branches of science; but why most of them are printed, there seems to be no reason, unless it be the reason why cheap razors are made. For my own part, I am thankful when we get a book such as Professor Cremona has given us, — a book so well designed to give the student more general views of geometry. ASAPH HALL.

Washington, D.C., Dec. 28.

Pleuro-pneumonia.

Referring to Mr. Butler's communication and your editorial remarks on p. 587, it may be of interest to put on record the fact that horses have suffered quite extensively, particularly in Indiana and Missouri, from what Dr. Salmon has decided to be vermicular or verminous bronchitis. He has fully treated of this disease, and illustrated the Strongyli which induce it in calves and lambs, in the veterinary part of the 'Agricultural report for 1885.' That producing the disease in horses seems to be Strongylus micrurus meplis, which is carefully figured on plate V., and described on p. 557. It is an elongate, thread-like worm from an inch and a half to two inches in length; and the point that I wish to put on record is that these Strongyli have very generally been supposed to have some connection with the narrow elongate eggs of Orchelimum glaberrimum. The eggs of this species are inserted in the pith of a number of different plants, and are particularly abundant in stalks of corn-tassels. The punctures were figured in my 'Fifth report on the insects of Missouri,' and again referred to in bulletin 6, U. S. fish commission. The bronchial disease which has been so prevalent and fatal to horses has been quite generally associated with these eggs, the supposition being that the horses became diseased by eating the corn tassels and stalks. The Orchelimum eggs have been received from about a dozen different correspondents, all of them independently making the same suggestion as to their connection with the bronchial worms, a rather remarkable instance of a prevalent and popular error arising from an imperfect knowledge of natural science.

C. V. RILEY.

Washington, D.C., Dec. 27.

Stereoscopic vision.

I would like to inquire of the readers of *Science* if it is generally known to be possible — and if, indeed, it is possible to all persons — to obtain a complete stereoscopic effect in viewing a *single* picture, and without a glass or other instrumental aid.

I have for several years been in the habit of practising a method in looking at photographs or good engravings, which, with me, makes the illusion perfect, and the objects pictured seem to stand out in full relief like the real objects.

In consists simply in entirely closing one eye, and shutting the other as nearly as possible, while admitting just sufficient light to afford a distinct, or at first rather dim, view of the picture. It is necessary first, however, to see that the picture is placed in a light corresponding as accurately as possible in direction with that in which the objects are represented in the picture: for example, if the scene is shown as lighted from the left, let the picture be so held that the actual illumination is from the left, and exactly at the same angle. An incongruity in this respect will spoil the result entirely. A little time is usually required to realize the full effect, and probably many persons unaccustomed to the experiment will need to exercise more patience at first than after some practice.

It is found, too, that a picture presenting strong lights and shades, as of photographs of objects in the direct sunlight, or engravings of the same character, produces the effect most readily. Take, for example, the engravings representing highly magnified views of the scenery on the surface of the moon, such as those illustrating Professor Langley's article 'The new astronomy,' in the *Century*. After looking at one of those in that manner for a few moments, the parts represented as elevations appear to rise from the paper; and, indeed, the flat surface disappears altogether, as well as the inky blackness of the shadows, and both elevations and depressions appear in startling reality.

The lights and shadows appear to be merely the illuminated and unilluminated portions of the same uniformly colored substance, showing it distinctly carved in all the reality of the forms intended to be indicated. It seems as if one could closely estimate the actual heights of the elevations, and the lengths of the shadows, and the precise position of the source of light.

The illusion once perfected, it may be retained while opening the eye a little, thus gaining a clearer view; but, carrying this a little too far, the scene at once 'flattens out' again, and becomes a mere lifeless black-and-white representation of the outlines, producing nothing of the impression of reality of contour: the landscape is gone.

As far as I am aware, this simple method is not generally known or thought of; nevertheless I am inclined to the belief that it would become easy to most persons after a little practice, and it is certainly very convenient, and greatly enhances the pleasure of viewing the many fine engravings almost everywhere to be seen. W. H. Pratt.

Davenport, Io., Dec. 14.

Laws against quacks.

I notice in your notes on the laws regulating the practice of medicine and surgery an omission to call attention to the fact that a bill (senate, 485) passed the senate last year, and would have passed the assembly but for the late date of its introduction, whereby it failed to be reached on the calendar. That bill embodied the points of agreement of those practitioners of medicine who have a legal status. It was based upon the bills introduced by the Medical society of the state of New York, so far as they were not concerned with the formation of a board of medical examiners. The State homœopathic society has directed its legislative committee to favor this bill if again introduced, as it probably will be. I do not think that either of the judges you name would consider the construction of the registration law adopted by the Medical society of the county of New York as absurd; nor would they differ in opinion from the judges before whom that construction has been maintained.

You will admit, I think, — as frankly as you admitted that the society was justified in the prosecution that elicited your comments, — that it is reasonable to require registration of every physician in a county who regularly practises or resides therein. No registered physician has been prosecuted for a consultation or occasional act of practice in a county wherein he was not registered. But the bill in question specifically meets your criticism, and, if introduced again, will be made even clearer on this point There is an opportunity at the next session of the legislature to codify the various acts restricting medical practice into a simple statute, and fair criticism of the bill in question will materially aid the purging of the statute-book of the present clumsy enactments.

W. A. Purrington.

New York, Dec. 21.

The Panama canal.

The article with the above title, from the pen of M. de Lesseps, copied by you in Dec. 3 issue from *The Scottish geographical magazine* for November, contains some errors both of fact and of inference.

Commercially the needs for and uses of the canal are misstated and overestimated. Trade must follow certain routes, governed by the earth's form and dimensions, and by the winds that blow or do not blow. For fear of the calm belt in Gulf of Mexico, the captain of a big ship, loaded with guano or nitrate of soda, would rather face the gales off Cape Horn. Because of the 'trades,' sailing ships from India and Australia would still go home *via* Cape of Good Hope. I have yet to meet a captain who would not elect Cape of Good Hope rather than Panama if loaded at a port even as far east as Philippines. A sailing-ship bound from San Francisco to Liverpool would think twice before she paid any thing to be put into the calms in land-locked water off Colon. Many captains have told me they would go on around the Cape Horn. Many cargoes are put on to sailing-ships, *because* they will be longer at sea than if sent per steam. It is no uncommon thing that a sailing-ship gets the same, and even more, freight than a steamer, because of the exigencies of the shipper or the condition of the market for merchandise. Hence the assumption that any of his '2' (p. 519), or that all of '1' or '3,' would seek Panama, is unfounded. A fair estimate, granting the correctness of his figures, would throw out '2,' and halve '1' and '3,' and leave, say, rising 2,000,000 tons per annum. In the table of distances, same page, London to Sydney, Havre to Sydney, he conveniently forgets that that traffic would use Suez rather than Panama. I fancy it is not generally known that the entire traffic of Suez is steam. There has never been an American merchantman through Suez, nor a sailing-ship of any nationality. The few sailers that have passed through were towed not only through Suez but the entire distance to and from port of departure (Bombay) and destination (Malta). Practically the entire traffic on Suez is steam

But M. de Lesseps does not refer to the most important factor in the problem. The evolution of the marine engine is still progressing. Steamers of moderate size and speed already approximate the expenses of sailers, not counting the further saving in interest on plant by reason of more frequent 'turns;' i.e., though a steamer may cost more than sailer, the former makes more voyages in a year, i.e., earns more freights. Before the Panama canal is finished, I doubt not such progress will have been made in compounding engines and in expansion of steam, that few new sailers will thereafter be built. The carrying-trade of the world will be done by steamers, just as the passenger trade has passed into their hands. Soon, as nations reckon life, sail will be limited to cruising for pleasure, fish or whale, or scientific research: even these will have steam power to go and come to place of resort. This change might and probably would throw the traffic of west coast America with east coast America and Europe into Panama canal; but Australia and India with Europe and America, never. Frank Goodwin.

Framingham, Mass., Dec. 18.

What was the rose of Sharon?

In *Science* for May 14 (vii. No. 171) is an article headed 'What was the rose of Sharon?' Though not familiar with either former or recent discussions of the question, I am interested in recalling an observation of my own while riding over the plain of Sharon on the road from Jaffa to Ramleh. It was about the middle of the afternoon, Feb. 18, 1859. The dark soil was for a considerable distance half covered with broad patches of bright red flowers. 'Roses of Sharon!' some one exclaimed. I forget whether it was the United States consul from Beirut or some one else of our party. As my impression now is, several persons who were likely to know concurred in saying that these flowers were commonly so called in that region. The flower which I gathered and pressed was afterwards identified by an American scholar as Anemone coronaria of Sibthorp's 'Flora Graeca.' The color of the dried petals is now a dark maroon. Fisk P. Brewer.

Grinnell, Io., Dec. 18.

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SCIENCE.–SUPPLEMENT.

FRIDAY, DECEMBER 31, 1886.

SEACOAST DEFENCES.

THE two excellent and valuable articles on seacoast defences which have been placed before the public within a few days of each other — the one by Lieut. Eugene Griffin of the corps of engineers, in the *Journal of the military service institution*, and the other by Capt. F. V. Greene of the engineers, in *Scribner's magazine* — should suffice to convince the most devoted advocate of a 'peace policy,' and the most economical of legislators, that something should be done by the authorities, and that speedily, as a mere matter of insurance if nothing more, to protect our defenceless seaports. Lieutenant Griffin's paper is more technical than Captain Greene's, as might be supposed from the fact of its being published in a magazine devoted exclusively to military interests; but while Captain Greene's article is popular, it is not superficial, and by a comparison of the two the intelligent reader can gain an excellent insight into the subject. Lieutenant Griffin summarizes the arguments against coast defences under three heads: 1. The navy should constitute our defence; 2. Torpedoes alone suffice to close any channel; 3. Earthen batteries of sufficient strength can be hastily thrown up in case of war. He then answers these objections by showing that the office of the navy is not defensive, but offensive: it should protect our commerce on the high seas, and injure that of our enemies. Moreover, fixed guns on land have many advantages over guns on floating supports. The second argument proceeds from entire ignorance of the nature and object of torpedoes. They have been introduced to offset the advantages gained by the attacking party in the invention of the screw-propeller. Their function is to harass an enemy's ships, and prevent them from running by batteries. Instead of being a substitute for fortifications, torpedoes presuppose the latter. The plea that earthworks can be thrown up as rapidly as need be, is shown to be equally flimsy. In winter no suitable earthworks could be thrown up at all in our northern states. And supposing the largest available force to work day and night, it would take more than a week to construct the seventy-foot parapet. What this means is evident when we remember that Bermuda is only seventy-one hours' steaming from Savannah, sixty-six hours from Charleston, and fifty-eight hours from New York; that a British fleet could get from Halifax to Portland in thirty-one hours, and to Boston in five hours more, or from Vancouver to San Francisco in ninety-six hours. Similarly a Spanish fleet at Havana is within forty-five hours of New Orleans. Then, as Lieutenant Griffin points out, the modern theory is to make war sudden, sharp, and decisive, and to make the defeated party pay all the expenses. The billion of dollars which Germany exacted from France in 1871 would be but a fraction of what we should have to pay to any hostile power that had our great seaports at its mercy.

We have on the Atlantic and Pacific and lake coasts "a series of great cities containing an aggregate population of more than five million souls, and destructible property which is carried on the assessors' books with a valuation of $4,000,000,000 (and which probably has an actual value of nearly twice as much), yielding annually a product in manufactured goods alone valued at over one thousand million dollars." Captain Greene shows that every man, woman, and child of this great population, and every dollar of this vast accumulation of wealth, is in danger of destruction by a hostile fleet. As he puts it, the problem is one of national insurance on life and property. Now, the usual annual premium on policies of insurance on life or property, with good risks, is from one to one and one-half per cent. In Captain Greene's judgment, less than half that percentage, computed on the sum total of property exposed, — say, $20,000,000, — expended annually for six years, would give us a complete system of insurance; that is, it would suffice to erect harbor defences stronger than any ships which could be brought against them, or, with an expenditure of $10,000,000 annually for six years, — a sum which is only about three per cent of our annual appropriations for the support of the government, — fully three-fourths of the lives and property on our coasts could be placed out of danger.

To these considerations Lieutenant Griffin adds the teaching of history, which is that the surest way to avoid war, with all its attendant ravages and losses, is by so thorough a preparation that no weak point is exposed to an enemy's attack, and no temptation is offered to his cupidity.

Besides dealing with the general question in the way indicated, both Captain Greene and Lieutenant Griffin discuss the various problems presented

by the great advances made in the apparatus both for attack and for defence in recent years. The absurd inadequacy of most if not all of our present fortifications is pointed out; for those of them that were erected about 1812 had only to withstand a 42-pound projectile fired with a muzzle energy of 800 foot-tons by a 10-pound charge of powder, and those built at the outbreak of the rebellion had only to withstand a 450-pound projectile fired with a muzzle energy of 9,000 foot-tons by a 130-pound charge of powder. The 16-inch rifle of 1886, which is 45 feet 6 inches long, weighs 115 tons, and fires a projectile weighing 2,300 pounds with a muzzle energy of 55,000 foot-tons by the explosion of 800 pounds of powder, would make short work of the best of them. The bombardment of Alexandria in 1882 is cited as an instance of what might quite readily happen to us. The defences of Alexandria were quite similar to ours, and their armament far superior to any that we have; yet eight English ironclads made their evacuation necessary after one day's bombardment.

Our forts, excellent during the masonry and earthen ages, have never been replaced in the iron age. On the other hand, twenty-eight of the Gruson cast-iron cupolas, which have been found efficient against the heaviest projectile, have been constructed in the harbors of Germany, Austria, Belgium, and Holland within a few years. Lieutenant Griffin's treatment of modern seacoast defences is very thorough, and, we should fancy, authoritative. He appends to his article a very valuable table, showing the name, age, displacement, draught, speed, class, thickness of armor and style of armament, of every foreign vessel available for offensive operations against the United States. The list is most imposing, and includes 71 English ships, 50 French, 14 German, 24 Russian, 19 Italian, 15 Turkish, 13 Austrian, 7 Danish, 7 Dutch, 5 Spanish, 6 Brazilian, 3 Japanese, and 3 Chilian. In the face of all this, "since 1875 not one penny has been appropriated for the construction of seacoast defences. The annual appropriation of $100,000 for preservation and repairs, increased to $175,000 since 1881, has not even sufficed to preserve our unfinished works, and our defences are actually in a worse condition to-day than they were ten years ago."

METEOROLOGY IN CALIFORNIA.

The ninth biennial report of the California state board of health (Sacramento, 1886) contains, besides much immediately pertinent to its office, several valuable descriptions and tables concerning meteorological data, which the members of the board wisely deem of importance in their professional studies. First in value is a long table of monthly rainfall, both for the past year and for the mean of several years, compiled by Lieut. W. A. Glassford, in charge of the Pacific coast division of the signal service. This is similar to the newspaper list prepared by the same officer, to which reference was lately made in *Science*, but it is here presented in more extended and convenient form. The weak spot in this table is the absence of any indication that the numerous stations possess good gauges, uniformly placed and well observed. On account of the difficulty in identifying the position of many of the stations, it would be of much service to readers at a distance if such a table as this could be reduced to graphic form in a series of monthly maps. They would necessarily be only provisional for the present, as some records are much shorter than others, so that the means are not properly comparable; but even these values would doubtless present a truer picture of west-coast precipitation than any yet prepared. It is to be hoped that similar tables and diagrams of temperature means may also be attempted.

Sergt. J. A. Barwick of the Sacramento signal office contributes a review of the meteorological conditions of his city for the past year, and a table of its temperature and rainfall since 1853 and 1849 from records early established by Drs. Logan and Hatch. The mean seasonal temperatures for 33 years are, spring, 59°.5; summer, 71°.7; autumn, 61°.5; winter, 48°.3; for the year, 60°.2. The extremes of the mean annual are 57°.5 (1880) and 62°.8 (1864). The absolute maxima rise to 103° or 105° in July and August, and the minima fall to 21° or 23° in January or February. The mean annual rainfall for 38 years is 19″.64, varying from 8.44 (1877) to 34.92 (1844): the mean for July is 0″.03; August, 0.003; December, 4.65; January, 3.84; February, 2.80; March, 2.91; counting the years by seasons, from July to June inclusive, the annual amounts range from 4.71 (1850–51) and 7.79 (1863–64) to 36.00 or a little more (1849–50, 1852–53, 1861–62). These pronounced contrasts of seasonal fall and great variations in the annual total show how completely unlike the western coast climate is the eastern and central. Sergeant Barwick presents also brief monthly notes of significant features, all of interest and value, but easily increased in both respects if the phenomena described were viewed in a broader way, from a more physical and less statistical stand-point. Annual and monthly averages show general planetary or continental relations; monthly extremes usually result from cyclonic disturbances, and should be stated in connection

with their transitory causes; diurnal variations, when not controlled or destroyed by importation of external conditions in the winds of strong gradients, are always significant of local geographic surroundings, and cannot be too closely examined for every separate station. Such local characteristics are, without doubt, known to many of our signal-service observers, but they have not often found their way into print. The annual reports of the chief signal officer hardly have room for them; the regrettable cessation of the 'signal-service notes' withdraws a fitting medium for their publication; scientific journals and local health or engineering reports may well open their pages to such material, when adequately prepared.

Three general papers should also be mentioned, — 'The climatology and diseases of southern California,' by H. S. Orme, M.D., of Los Angeles, president state board of health; 'Report on the . . . climatology . . . of Surprise and Goose Lake valleys,' by Dr. G. M. Kober, U. S. A., stationed at Fort Bidwell; and 'The coast climate of California,' by J. W. Robinson, M.D., of Crescent City. Dr. Orme mentions the pronounced control of the sea-breeze over the coast temperatures. During hot days, when thermometers in the interior rise to 115° to 125°, a stiff sea-breeze blows inland all along the southern coast, and prevents the littoral temperature from rising over 90°. He briefly mentions also a hot and dry wind, usually confined to limited localities a few miles inland, and frequently issuing from the Santa Ana pass in the Coast range, whence it takes its name. This is of particular interest, as it suggests the physical identity of the wind with the Foehn of Switzerland; and further details of its occurrence will therefore be impatiently awaited by those who are already tired of having to quote so largely from foreign sources for illustration of phenomena that certainly only need intelligent and discriminating observation for their discovery in our own country. The same expectation is raised by Dr. Kober's brief report on Surprise valley, — a flat depression in the north-eastern corner of the state, sixty miles north and south by eight east and west, with elevation of 4,600 feet, enclosed by an ascending barren plateau on the east, and separated from Goose Lake valley on the west by the Warner range, 6,000 to 8,000 feet high. The valley is well described in its geological relations by Russell in the 'Fourth annual report of the geological survey,' and shown to be the dried bed of an old lake, whose highest shore-line forms a conspicuous feature on the valley slopes, 550 feet above the present shallow alkaline lakes on the valley floor. Dr. Kober's figures give a characteristic great diurnal range of temperature, not uncommonly amounting to 50°; a relative humidity of 83 per cent in November, 1885, January and February, 1886, when 9″.09 of the total 19″.15 of precipitation occurs, according to a twenty-year record, contrasting strongly with the nearly absolute dryness of the summer: in September, 1885, the mean relative humidity was only 24.1 per cent, with a mean temperature of 64°. The winds show two diurnal maxima, indicating local control of their flow, — a west wind from the Warner range, with highest velocity shortly after midnight; and a southerly wind from the centre of the valley basin towards the high northern divide, with greatest strength just after noon. These directions clearly indicate the rhythmical flow of the cool, mountain, down-cast wind at night, and the warm, valley, up-cast wind by day. Winds of the Foehn species — commonly known in the north-west as the Chinook — ought to be felt here with much distinctness; and a comparison of records at Fort Bidwell, in Surprise valley, with others at some of the settlements in Goose Lake valley, on the western side of the Warner range, would doubtless lead to their accurate definition.

Dr. Robinson's paper is of especial value in its desire to discriminate between the good and poor records of the various coast stations. We fear that his criticism on observations at military posts may be only too just. These observations are in many cases merely perfunctory, in obedience to orders from headquarters, and are here described as too often made, not by the post-surgeon, but by the hospital steward, "who, from the recesses of his inner consciousness, draws up a report that reads well, but which has not the slightest foundation in fact." But in other cases great differences appear in neighboring records, where both observers are conscientious and painstaking: so that the variation must be laid, as it commonly may well be, to the instruments and their exposures. For example: Crescent City, on the coast, in latitude 42°, has two gauges: one is a five-inch square gauge, placed near the shore, at low level, and in line with a depression that leads an indraught of rainy winds from the sea; the other is a two-inch circular gauge, half a mile away at the lighthouse on a promontory, sixty feet over the ocean. From September, 1885, to May, 1886, inclusive, the first gauge collected 105″.28, and the second only 57″.69. Along with critical comparisons such as these, we regret to see the author's belief in the forest-control of rainfall. Rain-records have not yet been quoted in sufficient confirmation of this unwarranted conclusion; and even here we read, in regard to Crescent City, that the rainfall has diminished,

but "how much it is difficult to say, as observations conflict." Dr. Robinson also makes interesting reference to the winds of the coast, and describes the west winds of summer as greatly intensified by the (diurnal) heat of the interior valley, so that the sea-breeze is unusually strong over the passes that break down the elevation of the Coast range.

It is greatly to be wished that further detail should be presented of facts so interesting in themselves and so valuable in the physical description of our country. The suggestion made above concerning the cyclonic and local control of the weather elements is, it is believed, in a most profitable line for further work. Examples of similar weather-types, as indicated by recurrence of similar distribution of isobaric lines on the signal-office daily maps, should be brought together and discussed in search of their specific characteristics, instead of lost in the indiscriminate average of the monthly mean, itself of true value, but too often the end instead of the first step of the discussion. Local controls are found to prevail during anticyclonic weather, with high pressure and weak baric gradients: imported conditions appear with the approach and passage of cyclonic areas of low pressure and stronger gradients. Here is a wide field for observation and research. W. M. D.

CONSUMPTION IN PENNSYLVANIA.

The *New York medical journal* of Dec. 4 contains in full the exceedingly valuable contribution to the climatological study of consumption in Pennsylvania, by William Pepper, M.D., which was read at the third annual meeting of the American climatological association. In the inquiry which formed the basis of this paper, Dr. Pepper followed the plan adopted by Dr. Bowditch in investigating the same disease in Massachusetts in the years 1854–62. Dr. Bowditch, it will be remembered, found a law in the development of consumption in that state, which has for its central idea that the dampness of the soil of any township or locality is intimately connected with, and probably a cause of, the prevalence of consumption in that township or locality. Similar investigations, especially those of Dr. Buchanan in England, which were carried on in 1865, 1866, and 1867, confirm the views of Bowditch. In that country, where the subsoil was drained by sewers, and where the water-supply was improved, deaths from consumption diminished, falling 49 per cent in Salisbury, 47 in Ely, 43 in Rugby, and 41 in Banbury. With answers from physicians to twenty-eight questions propounded in a circular by Dr. Pepper, and the statistics of the tenth census of the United States, together with the topographical map of Professor Lesley as a basis, maps have been prepared showing the prevalence of consumption in Pennsylvania counties, and the relation between such prevalence and elevation, and mean annual temperature and rainfall. One of these maps is given in the journal referred to: the others will be published in the Transactions of the association. It is noticeable that those portions of the state where phthisis is rarest are the most elevated, having a general altitude of 1,500 to 2,000 feet, from 2,000 to 3,000 feet, and that its mortality increases as the altitude becomes less. In Philadelphia the wards having the least elevation, greatest density of population, and most inferior water-supply, furnish the greatest mortality from phthisis. The answers to the inquiries received from the state at large do not seem to indicate excessive soil moisture as the main causal condition of consumption in the state. A number of individual cases are given, in most of which damp and otherwise unsanitary conditions existed in and around the houses in which repeated cases occurred. This inquiry is a most timely one, as the tendency of the times seems to be to ignore conditions such as are here described, and to account for the disease only by the introduction of the bacilli of Koch. That these are the direct cause but few doubt, though unsanitary surroundings and heredity are important predisposing causes.

THAYER'S GREEK–ENGLISH LEXICON.

The only special dictionary in the English language hitherto available for students of the Greek New Testament has been a translation of Cremer's 'Biblisch-theologisches wörterbuch der Neutestamentlichen Gräcität.' This is not only very inconvenient in its arrangement, but is justly chargeable with a certain vagueness in its definitions. We think, therefore, that Professor Thayer has rendered an incalculable service to a numerous class of students by opening to them the treasures of German erudition to be found in Grimm's 'Clavis.' But he has done vastly more than this. Almost every page of the noble volume before us shows such signal traces of his critical scholarship, his profound learning, and his conscientious labor, as to make it only a matter of simple justice that the book should bear his name. In regard to the technical and theological aspects of the work, we have neither the desire nor the competence to pronounce an opinion; but, as a

A Greek-English lexicon of the New Testament, being Grimm's Wilke's Clavis Novi Testamenti. Tr. by Joseph Henry Thayer, D.D. New York, *Harper*, 1887. 4°.

monument of Greek lexicography, we consider that it reflects the highest honor upon American scholarship. After a careful comparison of results obtained from the long-continued use of other Greek lexicons, we feel constrained to pronounce the present one a marvel of accuracy. In his modest preface the editor expresses a keen sense of the shortcomings of his work, and seeks to enlist the co-operation of fellow-laborers to help rid it of every remaining blemish. Surely all who profit by his labors must rejoice to be able to serve him in this way. We will accordingly make such few suggestions as have occurred to us in the course of our examination of the volume.

In the summary of the interminable discussion about the distinction between *βούλομαι* and *θέλω*, which is found upon p. 286, it may be advisable to quote also the opinion of such an eminent Hellenist as the late Professor Shilleto. He states in a note to Demosthenes (*De falsa legatione*, 348, 14) that in *Attic* writers *βούλομαι* implies *a positive wish*, and *θέλω* the merely *negative idea of willingness, having no objection*. This is the view also of Sauppe, on Demosthenes (24, 3), who cites to the same effect Gottfried Hermann (*Zimmermann*, 1835, p. 299).

The very unusual expression *ἐκ τῶν ἰδίων*, which is found in John viii. 44, may be illustrated by the example of the same idiom in Thucydides (ii. 42), where it is opposed in signification to *κοινῶς*. It occurs also upon a bronze tablet containing a decree of the senate and people of Assos, in honor of Germanicus, discovered in the course of the explorations made upon that site by the Archaeological institute of America (*Clark's Report upon the investigations at Assos*, p. 134). It is there translated, 'at their own expense;' but the rendering, 'in a private capacity,' would seem to be more in conformity with the other instances of its use.

In the text the statement is made that the word *καταργέω* is found frequently in Paul's writings, who uses it twenty-five times; while elsewhere in the New Testament it occurs only twice; viz., in Luke xiii. 7 and in Hebrews ii. 14. We recollect that this exceptional use by Paul of one word is referred to by Rev. Robert Aris Wilmott, in his charming little volume on the pleasures of literature, as characteristic of his style. This would seem to make the word a proper candidate for a place among the words *peculiar* to Paul, contained in Appendix iv. 6, unless that term is intended by the editor to be restricted to words used by him alone among the New-Testament writers.

Under the word *πάσχω* we are told that it nowhere occurs in a *good* sense, unless either the adverb *εὖ*, or an accusative of the thing, is added. Sophocles' *Electra* (v. 169) is an instance to the contrary.

This slight contribution we offer towards the perfecting of a work whose beautiful mechanical execution makes it a delight to use it, and which testifies to a liberality on the part of the publishers as creditable as is the quality of the editing.

H. W. H.

THE WINNIPEG COUNTRY.

IT is with genuine pleasure that the critic takes hold of a volume like the present, so daintily gotten up with illustrations made for the book, and evidently the work of a practised hand. Then the story is told in such a simple and attractive manner, that one unconsciously drifts into the places of the astronomers, and feels each mosquito-bite as keenly as though he had actually experienced the bites in the flesh.

The journey was undertaken in 1860, before the days of railroads in that part of the continent, or, indeed, of steamboats — with the exception of the solitary stern-wheeler on the Red River, which broke down before our voyagers returned. The portion of the route lying beyond Fort Garry — the site of the now live city of Winnipeg — was made in the North canoe, a giant of its kind, which had been constructed years before for the accommodation of Sir George Stimson. Delay after delay occurred, for in even such a big canoe one could not brave the waves of Winnipeg with impunity. Then the current of the Saskatchewan proved to be unusually swift. The result of this combination was, that on the day of the eclipse the observers had not reached their destination: nor, in fact, had they advanced much beyond the outskirts of the eclipse belt. However, there was nothing for it but to get out on the first bit of solid ground that showed itself above the everlasting flooded marsh. An alcohol can on top of four stakes served as a pedestal for one telescope, while a birch-tree with lopped-off branches did similar duty for the other. Then, while the naturalist carefully beat time with a screw-driver, the clouds obscured the sun so that the astronomers who had dared hunger and mosquitoes could only note the minor phenomena of the last phase. It was provoking, but nothing could be done. By the time the instruments had been repacked, the river had risen higher and submerged the little island. A rest of one day, and then the homeward journey was begun. The delights of that portion of the trip can best be understood from the following: "Our long canoe-voyage of forty-

The Winnipeg country; or, Roughing it with an eclipse party. By A ROCHESTER FELLOW. Boston, *Cupples, Upham, & Co.*, 1886.

two days was over. We had been provisioned for thirty-five."

To add to their miseries, upon their arrival at Fort Garry they learned that the steamer had broken down: so the return journey was made overland in a Red River ox-cart. However, it must have had its pleasant side, or our author could not have looked back with so much evident pleasure to the experience. Not the least striking part of the volume is a set of views contrasting the state of things then at Fort Garry with the bustle and noise of a street of the present Winnipeg. The old Selkirk settlement has disappeared. But is not something better in its place?

COMPARATIVE MORPHOLOGY.

Students of vertebrate and invertebrate anatomy, both in this country and Great Britain, and other parts of the world where the English tongue is spoken, have much to be thankful for of late years; for during the last four or five of them have appeared in their language, either through original contribution or by translation, an exceptionally fine series of helpful handbooks of their science. Chief among these we notice upon our shelves the compact though useful little volume by Prof. F. Jeffrey Bell: the admirable manuals of Professors Martin and Mosle; the welcomed and invaluable translation of Claus's 'Text-book of zoölogy,' by Adam Sedgwick, in two volumes; the popular series contributed by Prof. A. S. Packard; a carefully revised third edition of Flower's excellent work on the osteology of the Mammalia; the favorite of all students of vertebrate anatomy, Mivart's 'Cat;' the best of little books, T. J. Parker's 'Zoötomy,' the work of the younger representative of a house the members of which now hold an unrivalled place in the science of modern times, which their extraordinarily fertile and brilliant contributions to vertebrate morphology have easily gained for them. And now comes a welcome volume from the pen of the senior son of this same family, an English translation of Wiedersheim's famous handbook of vertebrate anatomy.

It is to this last handsomely gotten up, and, almost without exception, exquisitely illustrated work, that we would here now devote a few words by way of comment and criticism. We find the book bound and printed with all that care for which the firm of Macmillan & Co. are so justly famous, and which they invariably bestow upon all their scientific publications. The work itself is divided into two parts, the first of which, entitled the 'Introduction,' comprises fifteen pages only, while the second or 'Special part' claims the remainder of the volume.

One of the principal points open for criticism in the introduction lies in its extreme brevity, and it must stand to reason that much must be sacrificed when one attempts to present the structural characters in general, and the mode of development in so important a group as the Vertebrata, in so limited a space. The great wonder is, that, notwithstanding this, the subjects treated in this part have been rendered so clearly and so thoroughly comprehensible. Nine excellent figures illustrate it, and it is completed by a helpful 'Table showing the gradual development of the Vertebrata in time.'

We find the 'Special part' divided up into sections, leading off with 'A. Integument:' followed by 'B. Skeleton;' then 'C. Muscular system;' 'D. Electric organs;' 'E. Nervous system;' 'F. Organs of nutrition;' 'G. Organs of respiration;' 'H. Organs of circulation;' and, finally, 'I. Urinogenital organs.' These several sections are found appropriately subdivided into other parts; and this plan has been found to answer the purposes both of the student and anatomist most admirably. Following as a natural sequence to such an arrangement as this, it affords, so far as the make-up of a volume is concerned, an excellent opportunity to offer a concise and convenient table of contents, presenting us with the several headings and divisions of the treatise, which has been done in the present instance. And to one at all familiar with the subject, this table of contents, supplemented, as it here is, by a wonderfully well-arranged and complete index (which latter contains but few omissions), leaves but little to be desired on this score. One word, however; for students are critical, and all are not thoroughly informed upon anatomical synonymes: so in future editions of this work it would be better to have index and text agree in every particular, and such errors, for instance, as indexing 'adrenal, 161,' and on p. 161 find 'suprarenal' only referred to, removed.

The section devoted to the treatment of the integument, though very brief, is excellent, and has been fully brought up to our present knowledge of the morphology of this structure and its appendages, in the several groups of the Vertebrata.

As we might expect, a considerable share of the work (pp. 30–111) is devoted to the 'Skeleton,' and it is ably dealt with under two headings; viz., (I.) Dermal skeleton (pp. 30–33), and (II.) The endoskeleton. Under the latter we are presented with a capital discussion of the 'Theory of the segmentation of the skull,' a fitting introduc-

Elements of the comparative anatomy of vertebrates. Tr. by W. Newton Parker. New York, *Macmillan*, 1886. 8°.

tion to the consideration of that part of the osseous system. Notwithstanding the generosity of the authors in allotting such a goodly share of their space to the treatment of this part of their subject, it has materially suffered, in common with the other systems of the economy, by the too extensive condensation of matter which characterizes the entire volume. Space will not permit us here to show the numerous instances wherein this is evident, and an example or two must suffice. As an instance, we fail to discover even a mention of such structures as are presented us in the vestiges of a pelvis in the whales and other marine mammals; and a similar omission applies to the limbless Reptilia, as in Ophisaurus, for example. Nor (were these well-known facts alluded to) would the absence of external limbs imply that 'pectoral and pelvic arches are also wanting,' as our authors would have us believe (p. 87). And in regard to these vestiges of organs, and rudiments of the same, we are, in view of the fact of the highly important part they play in general morphology, compelled to deplore the exceedingly slight attention they have had bestowed upon them throughout the book.

Without the assistance of some such handbook as Parker's 'Zoötomy,' we are quite certain that the special student would find but little to serve him in the chapter devoted to the musculature of the trunk and its appendages, for the subject has been generalized to the last degree; nor is this section entirely free from error, as, to instance, we are told that 'no trace of a transversalis can be distinguished' in birds, — a statement that is by no means true, for a well-developed one is found in Apteryx, and this muscle is also found in some of the higher groups.

It will be out of the question to even enumerate the many slips that have been allowed to creep into the section devoted to the 'Nervous system,' certain portions of which must be read with great caution by the student, who perhaps may have to rely upon this manual as final authority.

So far as the defects among the figures are concerned, one of the principal ones to be noted is the inaccurate representation of the lancelet on p. 247, as compared with the far more correct drawing of the same animal on p. 114. Aside from these strictures, however, and many others that could be made, this work, with its long list of brilliant, and for the most part accurate, woodcuts, some of which are even colored, greatly enhancing their usefulness, its excellent bibliographical references at the end of each section, and its list of general works following the preface, and finally its admirable arrangement and clearness of diction, will be sure to commend itself to English students and readers of the subject of which it, as a whole, so ably treats. R. W. S.

THE LIFE OF HAMILTON.

EARLY in the third volume of *Science*, at p. 23, we left Hamilton at the age of twenty-seven, young in years, but with the foundation of that superstructure, which is and always will be the marvel of mankind, well and deeply laid. Nothing can be of profounder interest than, in this second volume of his life, to watch the completion and growth to maturity of that imposing intellectual edifice so ably delineated by the accomplished author, whom Hamilton had nominated as his literary executor.

Mr. Graves finds enough in a year of Hamilton's life for a single sizable chapter, if not for more. So important an event to Hamilton as his marriage is given the prominence it ought to have: in fact, subsequent events justify his biographer in terming it 'a crisis of his life.' As might be surmised, the period of his courtship of Miss Bayly was no less a period of his courtship of the Muse; but it was not with Hamilton as it would have been with a mere poet, a period devoid of intellectual activity in other directions. His head was full of the mathematics of conical refraction, while his heart craved the satisfaction of that complete consent, long delayed, which he prized above every thing else.

On the whole, this book, as well as its companion volume, is a most diffuse one — at least, it so seems; but its compiler might well have made it even more so without undergoing in the long-run any charge of error in judgment; for every scrap of even meagre information becomes of importance, no one can tell how great, when related to a man like Hamilton, of whom it may more truly be said than of any other man of the present century, that his highest fame is still of the future. While the slow progress of the quaternion method is not a little remarkable, Hamilton appears to have been himself conscious that this might be the case, and to some extent foreshadowed it, somewhere speaking of the mathematicians of a thousand years hence, and their gratitude to him for the discovery of the new calculus.

We have nothing but the highest praise for Mr. Graves's delicate and trustworthy descriptions of Hamilton's character, and the incidents of his life. We have also to thank him for the charming glimpses he gives us of other distinguished names, in the space allowed their letters: what we see of

Life of Sir William Rowan Hamilton. Vol. ii. By ROBERT PERCEVAL GRAVES. London, *Longmans, Green & Co.* 8°.

Sedgwick, De Morgan, Maria Edgeworth, and a number of others, leads us to the strong wish that their correspondence might have been presented in even greater fulness. We have, indeed, the promise of an extended correspondence between Hamilton and De Morgan in the appendix to the succeeding volume of Hamilton's life. Mr. Graves has considerately provided indexes to both these volumes with a minuteness to suit the most exacting librarian: their thoroughness, in fact, nearly doubles the value of his work. The possibility of a collection of the strictly scientific and technical correspondence of Hamilton has already been hinted at, and will, on the completion of the present work, supplement this literary biography in a most important direction. Still beyond that, are the abounding mathematical remains of Hamilton, to edit and publish which in proper form would require the work of a genius little inferior to that of Hamilton himself. Mr. Graves promises to complete his biography in the next succeeding volume: let us hope that his promise is not well grounded, and that he will give us a fourth.

THE Young-Helmholtz theory of color-sensation has recently been put to the test of direct experimental proof by Herr Frithiof Holmgren (*Verhandlungen der physiolog. gesellschaft zu Berlin*, 1886, No. 18). As is well known, the theory is that the retina contains three sets of nerve-elements, each set capable of responding to the stimulus of a single color alone; and that the three colors which correspond to three sets of nerve-elements are green, red, and violet. These are the primary colors, and our sensation of all others is due to the simultaneous excitation of nerve-elements of different sets. Now, it is possible to produce a point of light so minute that its image on the retina shall have no greater dimensions than those of a single nerve-element or cone. If such a point of light in any color of the spectrum be examined in such a way that its image falls in turn upon different parts of the retina, it will, if the Young-Helmholtz theory be true, be seen only as red, green, or violet. If one of these primary colors be chosen for examination, it will appear in its own shade or not at all; but, if any other shade is employed, it will be resolved into its primary elements, and seem red, green, or violet, according to its composition and the particular cone on which it falls. The results of Holmgren's investigation were in entire accordance with the theory; red, green, and violet (indigo-violet) were unchanged; yellow appeared red, green, or colorless, in no part of the field distinctly yellow; blue was resolved similarly into green and violet. Further experiments, with a view to determining how many cones must receive simultaneous stimulus to produce the sensation of a particular color, show that yellow is seen as red or green even when the retinal image is considerably smaller than the section of a cone; while, to be seen as yellow, the image must be large enough to cover two or three cones.

— In a paper read before the chemical section of the fifty-ninth versammlung deutsch. naturforscher zu Berlin on the 23d of September, Herr Liebreich calls attention to the curious fact that certain chemical reactions, which proceed readily enough under ordinary conditions, are delayed or fail altogether when the liquid reagents are in the meniscus of a narrow tube. Herr Liebreich is inclined to regard this phenomenon as due to cohesion, and to conclude that certain reactions may be delayed, or permanently prevented from taking place, by the action of this force. Whether this be the true explanation or not, the fact is a very interesting one, and likely to be of the highest importance in its bearing on physiologico-chemical processes, which go on in the capillaries of the body. Many reactions which are readily effected in the laboratory may be altogether impossible in the living organism; and, since the character of the capillary walls may be of considerable influence, reactions which give normal results in the healthy organ, may yield quite different products or be entirely suppressed when the organ is diseased.

— A thesis on the geology and vein-structure of south-western Colorado, by Prof. T. B. Comstock of Champaign, Ill., lately published in the Transactions of the American institute of mining engineers, is one of the few detailed geological studies of a western locality, not the work of a government surveyor. It contains a general account of the geology of the region, in greatest part from original observations, and examines with especial care the succession of the volcanic rocks and the phenomena of mineral veins. The division of the paper that will perhaps excite most comment is the one that contains the author's views on the relation between the direction and the minerals of the veins in the Redpeak district. Six zones of mineral veins radiate from the peak as a centre, as follows: N. 38° E., arsenical; N. 79½ E., bismuth; S. 34½ E., galena-gray copper; S. 35 W., antimonial; S. 76½ W., argentiferous galena; N. 36½ W., silver sulphuret. Between these mineral zones there are wedge-shaped barren areas, which begin to be particularly noticeable along the course of the Animas River, skirting around the peak. Reference is made to the criticisms of Professor Ihlseng, who does not accept Mr. Comstock's views.

INDEX TO VOLUME VIII.

*** Names of contributors are printed in small capitals.*

ERRATA.

Page 68, col. 1, 14th line from top, for 'West' read 'East.'
" 68, " 1, 20th line from top, for 'West Indies' read 'East Indies.'
" 68, " 2, 15th line from bottom, for 'decreasing' read 'increasing.'
Page 190, col. 2, 2d line from bottom, for 'Grey' read 'Guy.'
" 631, " 1, 12th line from bottom, for 'meplis' read 'Mehlis.'
" 631, " 2, 1st line, for 'U. S. fish commission' read 'U. S. entomological commission.'